

22 April 1968

Materiel Test Procedure 6-3-260
U. S. Army Artillery BoardU. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY SERVICE TEST PROCEDURE

3459

SOUND-RANGING SET

1. OBJECTIVE

The purpose of this procedure is to determine under actual field operating conditions the degree to which the test item conforms to the specifications of applicable requirement documents - Qualitative Materiel Requirements (QMR), Technical Characteristics (TC), or Functional System Design Requirements (FSDR).

2. BACKGROUND

Sound ranging is a procedure used to locate the source of a sound by measuring the relative times of arrival of its sound wave at several accurately located positions on the ground. Sound ranging equipment is employed by the field artillery for use in locating hostile mortars and artillery, for registration and adjustment of friendly artillery, and for the collection of battlefield information.

Though basic design and theory of operation have remained unchanged despite progressive modifications and refinements of sound ranging equipment over the years, the basic design and theory of operation have brought about greater ruggedness and increased operator convenience, but the basic problems have been passed from one generation of equipment to the next including:

- a. Difficulty in processing the data charts when more than one weapon has been fired
- b. Generally poor signal-to-noise ratio in the presence of wind
- c. Long interconnecting wire lines between the microphones
- d. Incomplete knowledge of how sound is being propagated at any particular moment

NOTE: While this is, primarily, a meteorological consideration, it bears directly on the accuracy of sound ranging and constitutes a formidable system problem.

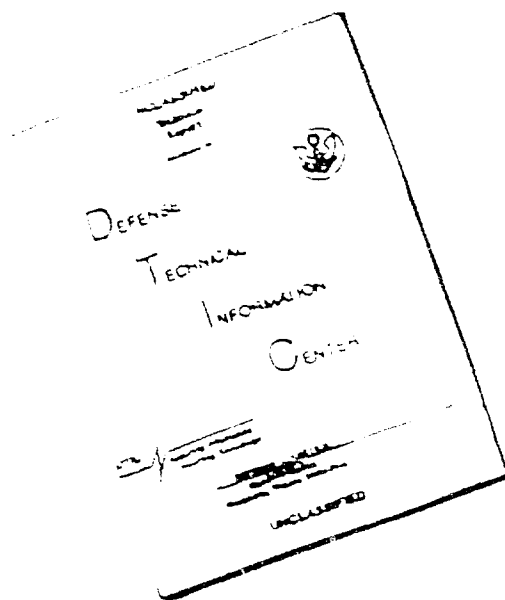
- e. Excessive time to set up the system and to process incoming signals
- f. Chart recording problems due to weak signals or poor signal-to-noise ratio cause errors in interpretation

A testing program for sound ranging equipment must be able to evaluate improvements and refinements, particularly in the problem areas mentioned. Modern developments, opening the door to radical departures from long-established techniques and to marked improvements in sound ranging capabilities, include:

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- a. Radio link data transmission
- b. Data presentation via oscilloscope
- c. Magnetic tape signal storage for analytical playback
- d. Correlation of sound sources and computation of locations by automatic data processing devices

3. REQUIRED EQUIPMENT

a. Firing Range(s) of suitable size to permit installation of the test item, with supporting equipment, to evaluate its capabilities of locating weapons by sound ranging at minimum and maximum ranges specified in the QMR

- b. HONEST JOHN Launcher with crew
- c. LITTLE JOHN Launcher with crew
- d. LANCE Missile System with crew
- e. 175-mm Gun with crew
- f. 8-inch Howitzer with crew
- g. 155-mm Howitzer with crew
- h. 105-mm Howitzer with crew
- i. 4.2-inch Mortar with crew
- j. 81-mm Mortar with crew
- k. Rifles, Machine Guns, and Recoilless Rifles
- l. Ammunition for all Weapons, as required
- m. Fire Direction Center for Mortars, as required
- n. Fire Direction Center for Artillery Weapons, as required
- o. Jamming Device(s)
- p. Survey Section with Equipment for fourth order survey
- q. Communications Facilities as required
- r. Meteorological Section, with Equipment
- s. Photographic Support Facilities and Equipment including film
- t. Vehicles for Transporting the Test Item, as required
- u. Maintenance Support Facilities
- v. Measuring and Inspection Equipment, as required by MTP 6-3-500 and MTP 6-3-501
- w. Electrical Equipment, as required by MTP 6-3-517
- x. Timing Devices, as required
- y. Ground and Air Transportation Equipment, as required by MTP 6-3-510 and MTP 7-3-515
- z. Wire and Electronic Equipment for Interference Tests, as required by MTP 6-3-513
- aa. Equipment for Air Drop Tests, as required by MTP 7-2-512
- bb. Acoustic Aids
- cc. Optical Surveillance Instruments
- dd. Electronic Surveillance Instruments
- ee. Aerial Cameras with Film
- ff. Aerial Photo Interpretation Facilities
- gg. Camouflaging Materials, as required
- hh. Road Test Courses, as follows:
 - 1) Paved roads
 - 2) Unpaved roads
 - 3) Cross-country terrain

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4.

REFERENCES

- A. Qualitative Materiel Requirements for the test item
- B. USATECOM Regulation 37-2, Financial Administration Funding for Transportation of Test Items
- C. USATECOM Regulation 385-6, Safety Release for USATECOM
- D. USATECOM Regulation 385-7, Safety Confirmation
- E. USATECOM Regulation 385-12, Verification of Safety of Materiel from Development through Testing and Supply to Disposition
- F. USATECOM Regulation 385-13, Safety Statements for Materiel in Development
- G. USATECOM Regulation 700-4, Reliability Program for USAMC Materiel
- H. USATECOM Regulation 705-2, Research and Development of Materiel, Documentary Test Plans and Reports
- I. USATECOM Regulation 705-4, Equipment Performance Reports
- J. USATECOM Regulation 705-12, Preliminary Operating and Maintenance Manual
- K. USATECOM Regulation 705-13, Use of Trade Names in Test Reports
- L. USATECOM Regulation 750-15, Maintenance of Supplies and Equipment - Maintenance Portion of the Service Test
- M. USAMC Regulation 37-17, Financial Administration Funding and Fiscal Policies and Procedures
- N. USAMC Regulation 70-1, Responsibilities for Application of Human Factors Engineering (HFE) in the Evaluation of Army Materiel (Subparagraphs 3a and 3b(7))
- O. USAMC Regulation 70-7, Test and Evaluation of Materiel
- P. USAMC Regulation 70-10, Processing of USATECOM Plans of Tests and Reports of Tests
- Q. USAMC Regulation 700-38, Correction of Defects Found During Materiel Life Cycle Testing
- R. USAMC 385-224, AMC Safety Manual
- S. AR 70-6, Financial Administration of the Army Research and Development Appropriation
- T. AR 70-10, Research and Development Materiel Testing
- U. AR 385-63, Regulations for Firing Ammunition for Training, Target Practice, and Combat
- V. AR 705-5, Army Research and Development
- W. AR 705-15, Research and Development of Materiel, Operation of Materiel under Extreme Conditions of Environment
- X. AR 705-16, Radio Frequency Allocations and Assignments for Equipment under Development
- Y. AR 705-25, Research and Development of Materiel, Reliability Program for Materiel and Equipment
- Z. AR 705-26, Research and Development of Materiel, Maintainability Program for Materiel and Equipment
- AA. AR 750-6, Maintenance Support Planning
- BB. Letter, AMCRD-SP-A, HQ, USAMC, 27 Jul 65, Subject: FY 67-72 AMC Research, Development, Test, and Evaluation (RDTE) Program - Target Years FY 67-68 (with 1 inclosure to CG, USA Weapons Command, et al)

CC. FM 6-122, Artillery Sound Ranging and Flash Ranging
DD. TM 11-2568, Sound Ranging Set GR-8
EE. MTP 6-3-500, Physical Characteristics
FF. MTP 6-3-501, Technical Inspection
GG. MTP 6-3-502, Personnel Training Requirements
HH. MTP 6-3-505, Emplacement, Preparation for Action and March Order
II. MTP 6-3-506, Durability
JJ. MTP 6-3-509, Effects of Weather
KK. MTP 6-3-510, Transportability of Communications, Surveillance,
and Electronic Equipment
LL. MTP 6-3-512, Compatibility with Related Equipment
MM. MTP 6-3-513, Qualitative Electromagnetic Interference
NN. MTP 6-3-516, Remote Operation
OO. MTP 6-3-517, Electrical Power Requirements
PP. MTP 6-3-523, Safety
QQ. MTP 6-3-524, Maintenance
RR. MTP 6-3-525, Human Factors
SS. MTP 7-3-512, Air Drop Capability (Suitability of Equipment for)
TT. MTP 7-3-515, Air Transportability - Internal (Suitability of
Equipment for)

5. SCOPE

5.1 SUMMARY

This MTP describes the methods used to determine the man-equipment compatibility and the capability and suitability of the test item as a sound ranging system. The major areas of evaluation and their included subtests are:

a. Pre-Test Operations consisting of:

- 1) Technical Inspection - A check to verify that the test item is complete and in satisfactory condition prior to the start of testing
- 2) Physical Characteristics - A verification of the physical characteristics of the test item
- 3) Electrical Characteristics - A study to ascertain the test item's electrical characteristics and a determination of its power requirements

b. Operational Characteristics consisting of:

- 1) Emplacement, Preparation for Action and March Order Suitability - A study to determine the ease of installation of the test item for operation and restoring it to its transport configuration under various conditions
- 2) Accuracy and Probability of Location of Hostile Weapons - A study to determine the capability of the test item to detect and locate various hostile weapons under a variety of conditions

- 3) Range Capabilities - A study to determine the maximum ranges at which the test item can detect various calibers of hostile weapons firing within the required and desired QMR specifications
- 4) Mutual Interference and Jamming Susceptibility - A determination of the mutual interference between the test item and electronic equipment operating nearby. A study to determine the susceptibility of the test item and associated equipment to deliberate jamming completes this subtest.
- 5) Computer Capabilities - A study to determine the ease and accuracy of operation of the test item computer and the ability of the operators to use it efficiently during a variety of missions. Test sets and power supply adequacy are also investigated.
- 6) Survey and Meteorological Requirement Capabilities - Studies to determine the ability of the test item to "shoot-in" its own sound base system and to cope with various met message errors and styles

c. Compatibility with Related Equipment - A study to determine the suitability of the test item for operations with its related equipment in various configurations

d. Transportability - A study to determine the suitability of the test item for surface and air transport

e. Air Drop Suitability - A study to determine the suitability of the test item and its associated equipment to be air dropped

f. Vulnerability to Detection - A study to determine the degree of security from aural and visual detection that the test item has. Ground and aerial observations are included.

g. Durability - An evaluation of the capability of the test item to withstand being transported over various types of terrain for a specified number of miles

h. Effects of Weather - An evaluation of the effects of various weather conditions on the operability of the test item

i. Maintainability and Reliability - An evaluation to determine the suitability of the test item to be maintained, the adequacy of its maintenance package, and its overall ability to operate over long periods of time without adjustment or replacement of components

j. Human Factors - An evaluation of the suitability of the test item for operation, servicing, transport and storage by service personnel without causing undue fatigue and mental errors

k. Value Analysis - Observations of the test item during the period of testing to determine possible ways to eliminate unnecessary costs at various stages of the design development and testing program

l. Safety - An evaluation of the safeness of the test item in its various configurations, under a variety of conditions, and the resultant safety hazards to service personnel

m. Post-Test Inspection - A repetition of the technical inspection to determine any adverse effects of testing on the test item

5.2 LIMITATIONS

None

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Scheduling

6.1.1.1 Personnel

a. Prior to the arrival of the test item, ensure that service personnel with appropriate backgrounds are adequately trained in the operation and maintenance of the test item and its associated equipment in accordance with the criteria established by MTP 6-3-502.

b. Record the following for all service personnel:

- 1) Rank
- 2) MOS
- 3) Training time
- 4) Experience

NOTE: Test personnel shall receive the minimum essential instruction in the operation of the test item and in the performance of maintenance on the test item at organizational, direct support, and general support echelons. The achievement of a skill level to operate the test item under simulated combat conditions shall be a requirement, assuming that the test item can achieve results as set forth in the QMR. Training shall include all aspects essential to test item operation including safety. Observations of operations and maintenance shall be made by technically qualified personnel.

c. Adequate training literature for test item operation and maintenance shall be available as required.

d. Ensure that experienced personnel are available for the duration of testing.

6.1.1.2 Facilities and Equipment

a. Select and schedule the use of testing sites and facilities as required by the applicable test section and the corresponding MTP.

b. Upon notice of the arrival of the test item or its estimated time of arrival, arrange for or secure the following:

- 1) Engineering safety release or a safety statement from the engineering agency as prescribed by references 4C and 4F
- 2) Vehicles required for transporting the test item equipment and personnel to the test sites
- 3) Maintenance support facilities, organization and personnel

- 4) Assistance of the U. S. Army Airborne, Electronics and Special Warfare Board (USAAESWBD) as required during the conduct of subtests involving air operations. (See paragraphs 6.2.3, 6.2.4, and 6.2.5.1.c)

6.1.2 Safety

- a. Verify that the test item safety statement is valid and up-to-date.
- b. Verify that all service personnel have been adequately trained in the safety requirements and the safety restrictions pertaining to the test item.
- c. Conduct the testing under field conditions simulating tactical operations but within the limitations imposed by the safety requirements.
- d. Observe safety precautions during tests where firing takes place as prescribed by reference 4U.

6.1.3 Test Site Preparations

Whenever required:

- a. Survey and record the positions for the following, as applicable, prior to testing:

- 1) Test item components
- 2) Artillery weapons (including missiles)
- 3) Mortars
- 4) Recoilless rifles and machine guns
- 5) Target areas

- b. Ensure that all preparations have been made at the selected test sites for the carrying out of required range safety precautions.

6.1.4 Pre-Test Operations

6.1.4.1 Technical Inspection

Subject the test item to a technical inspection as described by the applicable Sections of MTP 6-3-501.

6.1.4.2 Physical Characteristics

Determine the physical characteristics of the test item as described by applicable Sections of MTP 6-3-500.

6.1.4.3 Electrical Characteristics

Determine the electrical characteristics and the power requirements of the test item as described by the applicable sections of MTP 6-3-517.

6.2 TEST CONDUCT

a. Subtests shall be conducted concurrently with or in conjunction with other subtests, whenever possible, so that duplication of data collection can be eliminated and the total time required to collect the data can be minimized.

b. Tests shall be conducted under conditions as close as possible to those specified by this MTP.

6.2.1 Operational Characteristics

NOTE: 1. Performance of the test item shall be evaluated with respect to its conformance to QMR specifications. All firing problems shall be controlled with both weapons and the test item in surveyed tactical type positions. Operational characteristic data obtained for the test item shall be compared to corresponding data from "standard" sound ranging systems which have been operated under the same, or very nearly the same conditions.

2. At the completion of each subtest for the evaluation of its operational characteristics, the test item shall be subjected to a technical inspection as described by the applicable sections of MTP 6-3-501.

3. The test item shall be operated during all weather conditions pertaining for the duration of the test.

4. The test item shall be operated during daylight and darkness (blackout).

6.2.1.1 Emplacement, Preparation for Action and March Order Suitability

Determine the suitability of the test item to be emplaced, prepared for action and march ordered according to the conditions and the criteria of MTP 6-3-505.

6.2.1.2 Accuracy and Probability of Location of Hostile Weapons

Perform the following:

a. Install the test item in a simulated tactical position, of minimum length, (as specified in the QMR) on level terrain.

b. Emplace the following weapons (with crew) as targets for detection and location by the test item:

- 1) HONEST JOHN launching system
- 2) LITTLE JOHN launching system
- 3) LANCE missile system
- 4) 175-mm gun
- 5) 8-inch howitzer
- 6) 155-mm howitzer
- 7) 105-mm howitzer

- 8) 4.2-inch mortar
- 9) 81-mm mortar
- 10) Recoilless rifle
- 11) Machine gun
- 12) Rifles

c. Detect, locate and record the weapons listed in step b from their sound of firing under the following conditions:

- 1) One weapon firing at sporadic rates
- 2) One weapon firing rapid sustained fire
- 3) Two or more weapons firing single rounds, simultaneously
- 4) Two or more weapons firing rapid fire, simultaneously
- 5) Three or more weapons of different caliber firing simultaneously

NOTE: 1. Targets shall be introduced on a carefully controlled basis to facilitate comparison of control data with test item results.

2. A sufficient number of multiple firings shall be made to fully test the system's capability of discriminating between two or more sound sources emanating at the same time from different locations.

d. Weapon distribution with respect to the test item shall be based on requirements specified in the QMR.

e. Repeat steps a through d with the sound base length as follows:

- 1) Mid-length as specified in the QMR
- 2) Maximum length as specified in the QMR

f. Repeat steps b through e under the following test item emplacement conditions:

- 1) On rough, uneven terrain
- 2) In area containing heavy vegetation

g. Perform the accuracy and probability of location under conditions of darkness (blackout).

6.2.1.3 Range Capabilities

Perform the following:

a. Determine and record the test item range capabilities using the conditions specified in paragraph 6.2.1.2, in 500 meter increments, until the maximum effective ranges are established at which each target weapon can be detected and located.

b. Determine and record the following:

- 1) Type of weapons fired

- 2) Number of rounds fired from each weapon
- 3) Surveyed range to each location made

6.2.1.4 Mutual Interference and Jamming Susceptibility

Perform the following:

- a. Determine and record the effects of representative electronic equipment on the test item in accordance with the criteria of MTP 6-3-513.
- b. Determine and record the susceptibility of the test item to frequency jamming, over its entire frequency range, by jamming devices operated within a specified distance of the test item in accordance with the criteria of MTP 6-3-513.

6.2.1.5 Computer Capabilities

Determine and record the following during each test item operational mission:

- a. Ease and simplicity of computer operation and memory loading
- b. Occurrences of operator errors
- c. Time required to execute problem solutions accurately, as compared to other computation methods, such as manually operated calculators
- d. Adequacy of data inputs and outputs for the complete solution of the sound ranging problem
- e. Effectiveness of the computer test set(s) provided with the equipment
- f. Characteristics of the operational procedures which tend to increase or decrease the probability of:
 - 1) Erroneous inputs
 - 2) Misinterpretation of outputs (particularly during the stress of sustained operations)
- g. Power supply adequacy by intentionally inducing voltage variations

NOTE: If the power supply is a vehicle battery, or a source shared by other items, voltage variations may occur with the starting and stopping of engines, which in turn may adversely affect computer operation. Adverse effects shall be recorded.

6.2.1.6 Survey and Meteorological Requirement Capabilities

Perform the following:

- a. Determine and record the capability of the test item to "shoot-in" the sound base system as described by Chapter 7, paragraphs 39-42 of reference 4CC (and modified, if necessary).

- b. Determine and record the test item microphone positions relative to one another using the "survey" techniques as described in Chapter 7, paragraphs 39-42 of reference 4AB (and modified, if necessary).
- c. Introduce meteorological data errors intentionally, and determine and record the effect on the test item's locating accuracy.
- d. Record comments for the evaluation of the various methods of applying meteorological corrections during firings.
- e. Determine the test item meteorological message requirements using:

- 1) Present-type met messages
- 2) Proposed-type met messages

6.2.2 Compatibility with Related Equipment

Determine the compatibility of the test item with its related equipment as described by the applicable sections of MTP 6-3-512.

6.2.3 Transportability

- a. Determine the surface and air transportability of the test item as described by the applicable sections of MTP 6-3-510 and MTP 7-3-515.

NOTE: The conduct of airborne operations shall be the responsibility of the U. S. Army Airborne Electronics and Special Warfare Board (USAAESWBD).

- b. Conduct a technical inspection of the test item at the completion of the surface and air transportability tests as described by the applicable sections of MTP 6-3-501.

6.2.4 Air Drop Suitability

- a. Determine the air drop suitability of the test item as described by the applicable sections of MTP 7-3-512.

NOTE: The conduct of airborne operations shall be the responsibility of the U. S. Army Airborne, Electronics and Special Warfare Board (USAAESWBD).

- b. Conduct a technical inspection of the test item as the completion of each air drop operation as described by the applicable sections of MTP 6-3-501.

6.2.5 Vulnerability to Detection

6.2.5.1 Daylight Conditions

- a. Determine and record the maximum distance at which the test item and its associated equipment are audible to:

- 1) Unaided ear
- 2) Acoustic aids

b. Determine and record the maximum distances at which the test item is discernible without camouflage and with camouflage, from ground positions, using:

- 1) Unaided eye
- 2) Optical instruments
- 3) Electronic instruments

c. Determine and record the maximum altitudes at which the test item is discernible without camouflage and with camouflage, from aerial observations using:

- 1) Unaided eye
- 2) Optical instruments
- 3) Aerial photography

NOTE: The conduct of airborne operations shall be the responsibility of the U. S. Army Airborne Electronics and Special Warfare Board (USAAESWBD).

6.2.5.2 Darkness (Blackout) Conditions

Repeat paragraph 6.2.5.1 under conditions of darkness (blackout).

6.2.6 Durability

a. Determine the durability of the test item to withstand combat employment as described by the applicable sections of MTP 6-3-506.

NOTE: The test item and its' associated equipment shall be transported in selected vehicles at least 50 miles over paved roads, 100 miles over unpaved roads and 250 miles over cross-country roads.

6.2.7 Effects of Weather

Determine the effects of weather on the test item as described by the applicable sections of MTP 6-3-509.

6.2.8 Maintainability and Reliability

Test item maintainability and reliability shall be evaluated in accordance with USATECOM Regulation 750-15 APPENDIX II.

a. Determine the maintainability of the test item as described by the applicable sections of MTP 6-3-524.

b. Complete the authorized maintenance tasks in accordance with the test item maintenance allocation chart and technical literature.

c. Record the following:

- 1) Time and number of personnel required to perform each maintenance task on the test item, scheduled and non-scheduled
- 2) Frequency of repairs over the period of testing
- 3) Test item down time (cumulative)
- 4) Nomenclature of repair parts used

6.2.9 Human Factors

a. Determine the suitability of the test item design with respect to the man-equipment relationship as described by the applicable sections of MTP 6-3-525.

b. Determine and record the suitability and the compatibility of the test item with the service personnel who shall operate and maintain it, with respect to their skills, aptitudes and physical limitations.

NOTE: Each test item detail requiring human attention and/or manipulation shall be observed and evaluated.

6.2.10 Value Analyses

Record observations concerning possible ways to eliminate unnecessary costs during the design, development and procurement of the test item without compromise to the following:

- a. Quality of components
- b. Reliability (overall)
- c. Maintainability
- d. Operational performance
- e. Mission accomplishment

NOTE: Observations shall include, but shall not necessarily be limited to nonessential or nice-to-have features, components or accessories.

6.2.11 Safety

a. Determine the test item safety hazards resulting from storage, transport, operation and maintenance as described by the applicable sections of MTP 6-3-523.

b. Complete a safety confirmation in accordance with USATECOM Regulation 385-7.

6.2.12 Post-Test Inspection

Upon completion of testing, the test item shall be subjected to a final technical inspection as described by the applicable sections of MTP 6-3-501 and any deleterious effects of the testing program on the test item shall be recorded.

6.3 TEST DATA

6.3.1 Preparation for Test

6.3.1.1 Record the following for all service personnel:

- a. Rank
- b. MOS
- c. Training time in months
- d. Experience in years

6.3.1.2 Test Site Preparation

As required, record the positions for the following in grid coordinates:

- a. Test item components
- b. Artillery weapons (including missiles)
- c. Mortars
- d. Recoilless rifles, machine guns and rifles
- e. Target areas

6.3.1.3 Pre-Test Operations

6.3.1.3.1 Technical Inspection -

Record data as collected under the applicable sections of MTP 6-3-501.

6.3.1.3.2 Physical Characteristics -

Record data as collected under the applicable sections of MTP 6-3-500.

6.3.1.3.3 Electrical Characteristics -

Record data as collected under the applicable sections of MTP 6-3-517.

6.3.2 Test Conduct

6.3.2.1 Operational Characteristics

Record the following for each subtest conducted:

- a. Visibility condition (daylight, darkness)
- b. Ambient temperature in °F (at test item)
- c. Weather condition (clear, rain, snow, sleet, etc.)
- d. Meteorological data, as required by the QMR (usually provided by the met data unit)
- e. Test item nomenclature
- f. "Standard" item nomenclature, if required

6.3.2.1.1 Emplacement, Preparation for Action and March Order Suitability -

a. Record data as collected under the applicable sections of MTP 6-3-505.

b. Record data as collected under the applicable sections of MTP 6-3-501.

6.3.2.1.2 Accuracy and Probability of Location of Hostile Weapons -

a. Record the following for each mission fired during this subtest:

- 1) Number of weapons fired (1, 2, 3, etc.)
- 2) Firing rate (sporadic, rapid, etc.)
- 3) Weapon caliber and type (105-mm howitzer, 8-inch howitzer)
- 4) Number of rounds fired from each range zone (1, 2, 3, etc.)
- 5) Number of rounds detected for each weapon (1, 2, 3, etc.)
- 6) Location of each weapon in computed UTM grid coordinate
- 7) Test item--weapon intervening terrain (hills, woods, etc.)
- 8) Test item emplacement description (level terrain, rough uneven terrain, etc.)

b. Record data as collected under the applicable sections of MTP 6-3-501.

6.3.2.1.3 Range Capabilities -

a. Record the following for each mission fired in this subtest:

- 1) Number of weapons fired (1, 2, 3, etc.)
- 2) Firing rate (sporadic, rapid, etc.)
- 3) Weapon caliber and type (105-mm howitzer, 8-inch howitzer, etc.)
- 4) Number of rounds fired from each range zone (1, 2, 3, etc.)
- 5) Number of rounds detected for each weapon (1, 2, 3, etc.)
- 6) Maximum range at which weapon(s) can be located in meters
- 7) Test item--weapon azimuth(s) in mils
- 8) Test item--weapon intervening terrain (hills, woods, etc.)
- 9) Test item emplacement description (level terrain, rough uneven terrain, etc.)
- 10) Sound base length in feet
- 11) Surveyed range from test item to each weapon location in meters

b. Record data as collected under the applicable sections of MTP 6-3-501.

6.3.2.1.4 Mutual Interference and Jamming Susceptibility -

a. Record mutual interference data as collected in accordance with the applicable sections of MTP 6-3-513.

b. Record jamming data as collected in accordance with the applicable sections of MTP 6-3-513.

c. Record data as collected under the applicable sections of MTP 6-3-501.

6.3.2.1.5 Computer Capabilities -

Record the following for each test item operational mission:

- a. Ease and simplicity of computer operation and memory loading
- b. Occurrences of operator errors
- c. Time required to execute problem solutions in minutes
- d. Adequacy of data inputs and outputs for the complete solution of the sound ranging problem
- e. Effectiveness of the computer test set(s) provided with the equipment
- f. Characteristics of the operational procedures which tend to increase or decrease the probability of:

- 1) Erroneous inputs
- 2) Misinterpretation of outputs

6.3.2.1.6 Survey and Meteorological Requirement Capabilities -

Record the following for each performance of this subtest:

- a. Capability of the test item to "shoot in" the sound base system as required by the applicable sections of reference 4AB
- b. Procedural modifications required to accomplish step a
- c. Microphone positions of the test item relative to one another using the "survey" techniques as required by the applicable sections of reference 4CC
- d. Procedural modifications required to accomplish step c
- e. Effect of intentionally introduced meteorological data errors on the test item's locating accuracy by recording target locations under these circumstances in grid coordinates
- f. Comments on the various methods of applying meteorological corrections during the firing of the various missions
- g. Met message requirements of the test item using:
 - 1) Present-type met messages
 - 2) Proposed-type met messages

h. Data as collected under the applicable sections of MTP 6-3-501

6.3.2.2 Compatibility with Related Equipment

Record data as collected under the applicable sections of MTP 6-3-512.

6.3.2.3 Transportability

- a. Record data as collected under the applicable sections of MTP 6-3-510 and MTP 7-3-515.
- b. Record data as collected under the applicable sections of MTP 6-3-501, after surface and air transportability tests.

6.3.2.4 Air Drop Suitability

a. Record data as collected under the applicable sections of MTP 7-3-512.

b. Record data as collected under the applicable sections of MTP 6-3-501 after each air drop operation.

6.3.2.5 Vulnerability to Detection

a. Record the following for each aural observation:

- 1) Visibility condition (daylight, darkness)
- 2) Maximum distances in meters at which the test item and its associated equipment can be detected by:

- a) Unaided ear
- b) Acoustic aids

b. Record the following for each visual observation from ground positions:

- 1) Visibility condition (daylight, darkness)
- 2) Test item emplacement condition (camouflaged, uncamouflaged)
- 3) Maximum distances in meters at which the test item is discernible by:

- a) Unaided eye
- b) Optical instruments
- c) Electronic instruments

c. Record the following for each visual observation from aircraft:

- 1) Visibility condition (daylight, darkness)
- 2) Test item emplacement condition (camouflaged, uncamouflaged)
- 3) Maximum altitudes in feet at which the test item can be detected by:

- a) Unaided eye
- b) Optical instruments
- c) Aerial photography

6.3.2.6 Durability

a. Record data as collected under the applicable sections of MTP 6-3-506.

b. Record the following for the test item:

- 1) Total mileage over paved roads
- 2) Total mileage over secondary roads
- 3) Total mileage over cross-country terrain

6.3.2.7 Effects of Weather

Record data as collected under the applicable sections of MTP 6-3-509.

6.3.2.8 Maintainability and Reliability

Record the following:

- a. Data as collected under the applicable sections of MTP 6-3-524
- b. Type of maintenance performed (scheduled, non-scheduled)
- c. Time required to perform each maintenance task in hours
- d. Number of personnel required to perform each maintenance task
- e. Frequency of repairs over the period of testing (record dates)
- f. Test item down-time (cumulative) in hours
- g. Nomenclature of repair parts used

6.2.3.9 Human Factors

Record the following:

- a. Data as collected under the appropriate sections of MTP 6-3-525
- b. Observations of service personnel, during testing, and the suitability and compatibility of the test item with respect to their:
 - 1) Skills
 - 2) Aptitudes
 - 3) Physical Limitations

6.3.2.10 Value Analyses

Record observations concerning possible ways to eliminate unnecessary costs during the design, development and procurement of the test item without compromise to the following:

- a. Quality of components
- b. Reliability (overall)
- c. Maintainability
- d. Operational performance
- e. Mission accomplishment

6.3.2.11 Safety

Record data as collected under the applicable sections of MTP 6-3-523.

6.3.2.12 Post-Test Inspection

- a. Record data as collected under the applicable sections of MTP 6-3-501.
- b. Record any deleterious effects of the test program on the test item.

6.4 DATA REDUCTION AND PRESENTATION

Data obtained from all subtests covered by applicable MTP's shall be summarized, compared with "standard" data and evaluated according to procedures described in those applicable MTP's. Appropriate charts, graphs and tabulated summaries shall be used to present the data in a clear manner. Special consideration shall be given to any condition or circumstance contributing to any test result.

Calculations shall be performed as specified by the individual MTP's, whenever applicable, and all photographs, motion pictures and illustrative material shall be suitably identified.

In order to carry out the required missions under the various operational characteristics evaluation all computation made by the test item computer shall be utilized in the final evaluation and compared with other computational methods whenever pertinent.

Comparisons concerning the capability of the test to accurately detect and locate targets (under the various conditions), direct fire upon targets, accomplish "survey" requirements and assimilate met data shall be made with data from the standard item as well as the survey data collected. Final comparison presentation shall include:

- a. The computed coordinate locations of all detected weapons, detonations and test item locations
- b. Tabulated test results according to:
 - 1) Visibility conditions
 - 2) Weather conditions

In adjusting artillery fire upon targets (detonations) the mean point of impact of the fire-for-effect rounds shall be computed and compared with the data collected for the various conditions.

Final evaluation of the test item characteristics and capabilities shall be a comparison of the test results with the requirements defined by the QMR's, SDR's, TC's, MC's, and other established criteria set forth in the reference material.